



1

SEQUENCE LISTING

RECEIVED  
DEC 03 2002  
TECH CENTER 1600/2900

<110> DING, SHI-YOU  
ADNEY, WILLIAM S.  
VINZANT, TODD B.  
DECKER, STEPHEN R.  
HIMMEL, MICHAEL E.

<120> THERMAL TOLERANT CELLULASE FROM ACIDOTHERMUS  
CELLULOLYTICUS

<130> NREL 01-38

<140> 09/917,384

<141> 2001-07-28

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<170> PatentIn Ver. 2.1

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35 40 45

Pro Ser Asp Asn Gln Ile Lys Pro Gly Leu Gln Leu Val Asn Thr Gly  
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Ser Ser Ser Val Asp Leu Ser Thr Val Thr Val Arg Tyr Trp Phe Thr  
65 70 75 80

Arg Asp Gly Gly Ser Ser Thr Leu Val Tyr Asn Cys Asp Trp Ala Ala  
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Met Gly Cys Gly Asn Ile Arg Ala Ser Phe Gly Ser Val Asn Pro Ala  
100 105 110

Thr Pro Thr Ala Asp Thr Tyr Leu Gln Leu Ser Phe Thr Gly Gly Thr  
115 120 125

Leu Ala Ala Gly Gly Ser Thr Gly Glu Ile Gln Asn Arg Val Asn Lys  
130 135 140

Ser Asp Trp Ser Asn Phe Asp Glu Thr Asn Asp Tyr Ser Tyr Gly Thr  
145 150 155 160

Asn Thr Thr Phe Gln Asp Trp Thr Lys Val Thr Val Tyr Val Asn Gly  
165 170 175

cb

Val Leu Val Trp Gly Thr Glu Pro Ser Gly Ala Thr Ala Ser Pro Ser  
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 Ala Ser Ala Thr Pro Ser Pro Ser Ser Ser Pro Thr Thr Ser Pro Ser  
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 Met Tyr Asn Lys Ile His Asp Pro Ala Asn Gly Tyr Phe Ser Pro Gln  
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 Gly Ile Pro Tyr His Ser Val Glu Thr Leu Ile Val Glu Ala Pro Asp  
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 Ser Val Asp Leu Ser Thr Val Thr Val Arg Tyr Trp Phe Thr Arg Asp  
                     35                    40                    45  
 Gly Gly Ser Ser Thr Leu Val Tyr Asn Cys Asp Trp Ala Ala Met Gly  
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 Cys Gly Asn Ile Arg Ala Ser Phe Gly Ser Val Asn Pro Ala Thr Pro  
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 Thr Ala Asp Thr Tyr Leu Gln Leu Ser Phe Thr Gly Gly Thr Leu Ala  
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Val Glu Thr Leu Ile Val Glu Ala Pro Asp Tyr Gly His Glu Thr Thr  
 35 40 45

Ser Glu Ala Tyr Ser Phe Trp Leu Trp Leu Glu Ala Thr Tyr Gly Ala  
 50 55 60

Val Thr Gly Asn Trp Thr Pro Phe Asn Asn Ala Trp Thr Thr Met Glu  
 65 70 75 80

Thr Tyr Met Ile Pro Gln His Ala Asp Gln Pro Asn Asn Ala Ser Tyr  
 85 90 95

Asn Pro Asn Ser Pro Ala Ser Tyr Ala Pro Glu Glu Pro Leu Pro Ser  
 100 105 110

Met Tyr Pro Val Ala Ile Asp Ser Ser Val Pro Val Gly His Asp Pro  
 115 120 125

Leu Ala Ala Glu Leu Gln Ser Thr Tyr Gly Thr Pro Asp Ile Tyr Gly  
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Pro Gly Gly Gly Cys Glu Leu Gly Pro Ser Ala Lys Gly Val Ser Tyr  
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Ile Asn Thr Phe Gln Arg Gly Ser Gln Glu Ser Val Trp Glu Thr Val  
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 195 200 205

Val Asp Leu Phe Ile Gln Gly Ser Thr Pro Pro Gln Trp Lys Tyr Thr  
 210 215 220

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 260 265 270  
 Asp Lys Tyr Phe Lys Gln Val Gly Asn Cys Tyr Pro Ala Ser Ser Cys  
 275 280 285  
 Pro Gly Ala Thr Gly Arg Gln Ser Glu Thr Tyr Leu Ile Gly Trp Tyr  
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 Tyr Ala Trp Gly Gly Ser Ser Gln Gly Trp Ala Trp Arg Ile Gly Asp  
 305 310 315 320  
 Gly Ala Ala His Phe Gly Tyr Gln Asn Pro Leu Ala Ala Trp Ala Met  
 325 330 335  
 Ser Asn Val Thr Pro Leu Ile Pro Leu Ser Pro Thr Ala Lys Ser Asp  
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 Asn Tyr Gly Thr Pro Pro Ala Gly Asp Ser Thr Phe Tyr Gly Met Ala  
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 Tyr Asp Trp Glu Pro Val Tyr His Asp Pro Pro Ser Asn Asn Trp Phe  
 405 410 415  
 Gly Phe Gln Ala Trp Ser Met Glu Arg Val Ala Glu Tyr Tyr Tyr Val  
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 Thr Gly Asp Pro Lys Ala Lys Ala Leu Leu Asp Lys Trp Val Ala Trp  
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 Val Lys Pro Asn Val Thr Thr Gly Ala Ser Trp Ser Ile Pro Ser Asn  
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 Gly Val Ala Ala Ala Leu Ala Lys Thr Leu Glu Tyr Tyr Ala Ala Lys  
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c6  
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Asp Gly Leu Tyr Ile Pro Ser Gly Trp Thr Gly Thr Met Pro Asn Gly  
 565 570 575

Asp Gln Ile Lys Pro Gly Ala Thr Phe Leu Ser Ile Arg Ser Trp Tyr  
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Thr Lys Asp Pro Gln Trp Ser Lys Val Gln Ala Tyr Leu Asn Gly Gly  
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 35 40 45

Pro Thr Ala Thr Ser Phe Thr Asp Thr Gly Leu Ala Ala Gly Thr Ser  
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Gln Ser Phe Ala Gly  
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26  
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 Lys Asn Leu Ser Tyr Asn Asn Val Ile Gln Pro Gly Gln Ser Thr Thr  
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 Met Ile Pro Gln His Ala Asp Gln Pro Asn Asn Ala Ser Tyr Asn Pro  
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 Asn Ser Pro Ala Ser Tyr Ala Pro Glu Glu Pro Leu Pro Ser Met Tyr  
                   100                  105                  110

C6  
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Pro Val Ala Ile Asp Ser Ser Val Pro Val Gly His Asp Pro Leu Ala  
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 Gly Gly Cys Glu Leu Gly Pro Ser Ala Lys Gly Val Ser Tyr Ile Asn  
 165 170 175  
 Thr Phe Gln Arg Gly Ser Gln Glu Ser Val Trp Glu Thr Val Thr Gln  
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 Pro Thr Cys Asp Asn Gly Lys Tyr Gly Gly Ala His Gly Tyr Val Asp  
 195 200 205  
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 225 230 235 240  
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 Ala Ser Leu Gln Arg Gln Leu Glu Phe Tyr Gln Trp Leu Gln Ser Ala  
 355 360 365  
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 Gly Thr Pro Pro Ala Gly Asp Ser Thr Phe Tyr Gly Met Ala Tyr Asp  
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 Trp Glu Pro Val Tyr His Asp Pro Pro Ser Asn Asn Trp Phe Gly Phe  
 405 410 415

C6  
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Gln Ala Trp Ser Met Glu Arg Val Ala Glu Tyr Tyr Tyr Val Thr Gly  
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Asp Pro Lys Ala Lys Ala Leu Leu Asp Lys Trp Val Ala Trp Val Lys  
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Trp Ser Gly Gln Pro Asp Thr Trp Asn Pro Ser Asn Pro Gly Thr Asn  
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Ala Ala Ala Leu Ala Lys Thr Leu Glu Tyr Tyr Ala Ala Lys Ser Gly  
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Asp Tyr Ser Arg Phe Thr Gln Val Tyr Asp Pro Thr Thr Gly Asp Gly  
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Ile Lys Pro Gly Ala Thr Phe Leu Ser Ile Arg Ser Trp Tyr Thr Lys  
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Asp Pro Gln Trp Ser Lys Val Gln Ala Tyr Leu Asn Gly Gly Pro Ala  
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Pro Thr Phe Asn Tyr His Arg Phe Trp Ala Glu Ser Asp Phe Ala Met  
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35 40 45

C6  
Cont

Ala Tyr Ser Tyr Trp Leu Trp Leu Glu Ala Leu Tyr Gly Gln Val Thr  
 50 55 60  
 Gln Asp Trp Ala Pro Leu Asn His Ala Trp Asp Thr Met Glu Lys Tyr  
 65 70 75 80  
 Met Ile Pro Gln Ser Val Asp Gln Pro Thr Asn Ser Phe Tyr Asn Pro  
 85 90 95  
 Asn Ser Pro Ala Thr Tyr Ala Pro Glu Phe Asn His Pro Ser Ser Tyr  
 100 105 110  
 Pro Ser Gln Leu Asn Ser Gly Ile Ser Gly Gly Thr Asp Pro Ile Gly  
 115 120 125  
 Ala Glu Leu Lys Ala Thr Tyr Gly Asn Ala Asp Val Tyr Gln Met His  
 130 135 140  
 Trp Leu Ala Asp Val Asp Asn Ile Tyr Gly Phe Gly Ala Thr Pro Gly  
 145 150 155 160  
 Ala Gly Cys Thr Leu Gly Pro Thr Ala Thr Gly Thr Ser Phe Ile Asn  
 165 170 175  
 Thr Phe Gln Arg Gly Pro Gln Glu Ser Val Trp Glu Thr Val Pro Gln  
 180 185 190  
 Pro Ser Cys Glu Glu Phe Lys Tyr Gly Gly Lys Asn Gly Tyr Leu Asp  
 195 200 205  
 Leu Phe Thr Lys Asp Ala Ser Tyr Ala Lys Gln Trp Lys Tyr Thr Ser  
 210 215 220  
 Ala Ser Asp Ala Asp Ala Arg Ala Val Glu Ala Val Tyr Trp Ala Asn  
 225 230 235 240  
 Gln Trp Ala Thr Glu Gln Gly Lys Ala Ala Asp Val Ala Ala Thr Val  
 245 250 255  
 Ala Lys Ala Ala Lys Met Gly Asp Tyr Leu Arg Tyr Thr Leu Phe Asp  
 260 265 270  
 Lys Tyr Phe Lys Lys Ile Gly Cys Thr Ser Pro Thr Cys Ala Ala Gly  
 275 280 285  
 Gln Gly Arg Glu Ala Ala His Tyr Leu Leu Ser Trp Tyr Met Ala Trp  
 290 295 300  
 Gly Gly Ala Thr Asp Thr Ser Ser Gly Trp Ala Trp Arg Ile Gly Ser  
 305 310 315 320  
 Ser His Ala His Phe Gly Tyr Gln Asn Pro Leu Ala Ala Trp Ala Leu  
 325 330 335  
 Ser Thr Asp Pro Lys Leu Thr Pro Lys Ser Pro Thr Ala Lys Ala Asp  
 340 345 350

C6  
 cont

Trp Ala Ala Ser Met Gln Arg Gln Leu Glu Phe Tyr Thr Trp Leu Gln  
 355 360 365  
 Ala Ser Asn Gly Gly Ile Ala Gly Gly Ala Thr Asn Ser Trp Asp Gly  
 370 375 380  
 Ala Tyr Ala Gln Pro Pro Ala Gly Thr Pro Thr Phe Tyr Gly Met Gly  
 385 390 395 400  
 Tyr Thr Glu Ala Pro Val Tyr Val Asp Pro Pro Ser Asn Arg Trp Phe  
 405 410 415  
 Gly Met Gln Ala Trp Gly Val Gln Arg Val Ala Glu Leu Tyr Tyr Ala  
 420 425 430  
 Ser Gly Asn Ala Gln Ala Lys Lys Ile Leu Asp Lys Trp Val Pro Trp  
 435 440 445  
 Val Val Ala Asn Ile Ser Thr Asp Gly Ala Ser Trp Lys Val Pro Ser  
 450 455 460  
 Glu Leu Lys Trp Thr Gly Lys Pro Asp Thr Trp Asn Ala Ala Ala Pro  
 465 470 475 480  
 Thr Gly Asn Pro Gly Leu Thr Val Glu Val Thr Ser Tyr Gly Gln Asp  
 485 490 495  
 Val Gly Val Ala Ala Asp Thr Ala Arg Ala Leu Leu Phe Tyr Ala Ala  
 500 505 510  
 Lys Ser Gly Asp Thr Ala Ser Arg Asp Lys Ala Lys Ala Leu Leu Asp  
 515 520 525  
 Ala Ile Trp Ala Asn Asn Gln Asp Pro Leu Gly Val Ser Ala Val Glu  
 530 535 540  
 Thr Arg Gly Asp Tyr Lys Arg Phe Asp Asp Thr Tyr Val Ala Asn Gly  
 545 550 555 560  
 Asp Gly Ile Tyr Ile Pro Ser Gly Trp Thr Gly Thr Met Pro Asn Gly  
 565 570 575  
 Asp Val Ile Lys Pro Gly Val Ser Phe Leu Asp Ile Arg Ser Phe Tyr  
 580 585 590  
 Lys Lys Asp Pro Asn Trp Ser Lys Val Gln Thr Phe Leu Asp Gly Gly  
 595 600 605  
 Ala Glu Pro Gln Phe Arg Tyr His Arg Phe Trp Ala Gln Thr Ala Val  
 610 615 620  
 Ala Gly Ala Leu Ala Asp Tyr Ala Arg Leu Phe Asp Asp Gly Thr Thr  
 625 630 635 640

<210> 11  
 <211> 642  
 <212> PRT

C6  
 Cont

&lt;213&gt; Thermobifida fusca

&lt;400&gt; 11

Ser Tyr Asp Gln Ala Phe Leu Glu Gln Tyr Glu Lys Ile Lys Asp Pro  
 1 5 10 15  
 Ala Ser Gly Tyr Phe Arg Glu Phe Asn Gly Leu Leu Val Pro Tyr His  
 20 25 30  
 Ser Val Glu Thr Met Ile Val Glu Ala Pro Asp His Gly His Gln Thr  
 35 40 45  
 Thr Ser Glu Ala Phe Ser Tyr Tyr Leu Trp Leu Glu Ala Tyr Tyr Gly  
 50 55 60  
 Arg Val Thr Gly Asp Trp Lys Pro Leu His Asp Ala Trp Glu Ser Met  
 65 70 75 80  
 Glu Thr Phe Ile Ile Pro Gly Thr Lys Asp Gln Pro Thr Asn Ser Ala  
 85 90 95  
 Tyr Asn Pro Asn Ser Pro Ala Thr Tyr Ile Pro Glu Gln Pro Asn Ala  
 100 105 110  
 Asp Gly Tyr Pro Ser Pro Leu Met Asn Asn Val Pro Val Gly Gln Asp  
 115 120 125  
 Pro Leu Ala Gln Glu Leu Ser Ser Thr Tyr Gly Thr Asn Glu Ile Tyr  
 130 135 140  
 Gly Met His Trp Leu Leu Asp Val Asp Asn Val Tyr Gly Phe Gly Phe  
 145 150 155 160  
 Cys Gly Asp Gly Thr Asp Asp Ala Pro Ala Tyr Ile Asn Thr Tyr Gln  
 165 170 175  
 Arg Gly Ala Arg Glu Ser Val Trp Glu Thr Ile Pro His Pro Ser Cys  
 180 185 190  
 Asp Asp Phe Thr His Gly Gly Pro Asn Gly Tyr Leu Asp Leu Phe Thr  
 195 200 205  
 Asp Asp Gln Asn Tyr Ala Lys Gln Trp Arg Tyr Thr Asn Ala Pro Asp  
 210 215 220  
 Ala Asp Ala Arg Ala Val Gln Val Met Phe Trp Ala His Glu Trp Ala  
 225 230 235 240  
 Lys Glu Gln Gly Lys Glu Asn Glu Ile Ala Gly Leu Met Asp Lys Ala  
 245 250 255  
 Ser Lys Met Gly Asp Tyr Leu Arg Tyr Ala Met Phe Asp Lys Tyr Phe  
 260 265 270  
 Lys Lys Ile Gly Asn Cys Val Gly Ala Thr Ser Cys Pro Gly Gly Gln  
 275 280 285

C6  
 cont

Gly Lys Asp Ser Ala His Tyr Leu Leu Ser Trp Tyr Tyr Ser Trp Gly  
 290 295 300  
 Gly Ser Leu Asp Thr Ser Ser Ala Trp Ala Trp Arg Ile Gly Ser Ser  
 305 310 315 320  
 Ser Ser His Gln Gly Tyr Gln Asn Val Leu Ala Ala Tyr Ala Leu Ser  
 325 330 335  
 Gln Val Pro Glu Leu Gln Pro Asp Ser Pro Thr Gly Val Gln Asp Trp  
 340 345 350  
 Ala Thr Ser Phe Asp Arg Gln Leu Glu Phe Leu Gln Trp Leu Gln Ser  
 355 360 365  
 Ala Glu Gly Gly Ile Ala Gly Gly Ala Thr Asn Ser Trp Lys Gly Ser  
 370 375 380  
 Tyr Asp Thr Pro Pro Thr Gly Leu Ser Gln Phe Tyr Gly Met Tyr Tyr  
 385 390 395 400  
 Asp Trp Gln Pro Val Trp Asn Asp Pro Pro Ser Asn Asn Trp Phe Gly  
 405 410 415  
 Phe Gln Val Trp Asn Met Glu Arg Val Ala Gln Leu Tyr Tyr Val Thr  
 420 425 430  
 Gly Asp Ala Arg Ala Glu Ala Ile Leu Asp Lys Trp Val Pro Trp Ala  
 435 440 445  
 Ile Gln His Thr Asp Val Asp Ala Asp Asn Gly Gly Gln Asn Phe Gln  
 450 455 460  
 Val Pro Ser Asp Leu Glu Trp Ser Gly Gln Pro Asp Thr Trp Thr Gly  
 465 470 475 480  
 Thr Tyr Thr Gly Asn Pro Asn Leu His Val Gln Val Val Ser Tyr Ser  
 485 490 495  
 Gln Asp Val Gly Val Thr Ala Ala Leu Ala Lys Thr Leu Met Tyr Tyr  
 500 505 510  
 Ala Lys Arg Ser Gly Asp Thr Thr Ala Leu Ala Thr Ala Glu Gly Leu  
 515 520 525  
 Leu Asp Ala Leu Leu Ala His Arg Asp Ser Ile Gly Ile Ala Thr Pro  
 530 535 540  
 Glu Gln Pro Ser Trp Asp Arg Leu Asp Asp Pro Trp Asp Gly Ser Glu  
 545 550 555 560  
 Gly Leu Tyr Val Pro Pro Gly Trp Ser Gly Thr Met Pro Asn Gly Asp  
 565 570 575  
 Arg Ile Glu Pro Gly Ala Thr Phe Leu Ser Ile Arg Ser Phe Tyr Lys  
 580 585 590

C6  
 Cont



Asn Asp Pro Leu Trp Pro Gln Val Glu Ala His Leu Asn Asp Pro Gln  
595 600 605

Asn Val Pro Ala Pro Ile Val Glu Arg His Arg Phe Trp Ala Gln Val  
610 615 620

Glu Ile Ala Thr Ala Phe Ala Ala His Asp Glu Leu Phe Gly Ala Gly  
625 630 635 640

Ala Pro

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